S 8010/KK

Statement of Translation

I,

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declare as follows:

1. That I am well acquainted with both the English and German languages, and

2. That the attached English translation of the German Utility Model application **202 13 166.1 filed on August 28, 2002 "Humerusnagel"** is a true and correct translation made by me to the best of my knowledge and belief.

20.12.2006
(Date)

P. Schindelmann
(Signature of Translator)

DESCRIPTION

[0001] The invention relates to a humeral nail according to the preamble of claim 1.

[0002] It is known that fractures of the upper arm often occur in the proximal region, particularly in the head region of the humerus. For the surgical care of such fractures, it is already known to provide a so-called locking nail. It is driven into the humerus channel from the proximal direction and it has locking bores both in the proximal region as well as in the distal region, through which bone screws are guided in order to secure the locking nail against axial dislocation and torsion. The bone screws in the proximal region serve also for the fixing of the bone fragments.

[0003] A humeral nail of the described type has become known from US 5 427 444. The nail comprises an oblong shaft and has four transverse bores in the proximal region, which bores are disposed axially spaced apart and offset from one another in the circumferential direction. The nail shaft is bent.

[0004] The problem underlying the invention is to improve a humeral nail of the aforementioned type to the effect that an even more effective fixing of the nail and the fracture fragments can take place.

[0005] This problem is solved with the features of claim 1.

[0006] In the humeral nail according to the invention, the proximal transverse bore, i.e. the one which is situated close to the proximal end, is disposed with its axis diagonal to the longitudinal axis of the nail shaft.

[0007] In a nail inserted in the proximal direction into the humerus, the nail sits on the outer side of the humerus head, and the transverse bores in the proximal portion are arranged such that the locking screws can be screwed into the humerus head from different directions. In the nail according to the invention, the diagonal arrangement of the proximal transverse bore is such that the bone screw is screwed in from the outside towards the inside diagonally downwards. As a result, the bone screw is arranged in an anatomically more favourable fashion, because by doing so the transmission force to the nail is configured in a more favourable manner. In addition, the bone screw can receive a greater length because it can be put into the humerus head across a greater length.

Overall, therefore, the surgical care of fractures in the head region of the humerus is improved by the nail according to the invention.

[0008] According to one embodiment of the invention, the inclination of the axis of the proximal transverse bore with respect to the longitudinal axis of the nail shaft is at an angle of 80°.

[0009] As already mentioned, several transverse bores are provided in the proximal portion of the nail shaft. According to one embodiment of the invention, the axis of the distal transverse bore in the proximal portion, i.e. the traverse bore which has the greatest distance from the proximal end of the nail shaft, is also disposed diagonally with respect to the longitudinal axis of the nail shaft. The angulation is such that the axes of the proximal and the distal transverse bores converge and diverge respectively. They are therefore directed into opposite directions. This measure, too, proves to be extremely advantageous in fractures of the humerus head, because here too the bone screw can be selected to be longer and can be put into the endangered regions of the humerus head more effectively.

[0010] According to one embodiment of invention, the angular offset of the distal transverse bore with respect to the proximal transverse bore is approximately 25°, this offset preferably being directed into the direction opposite to the offset of the transverse bore which follows the proximal transverse bore.

[0011] Preferably, four transverse bores are provided in the proximal portion, the two middle bores preferably running with their axis perpendicular to the longitudinal axis of the nail shaft.

[0012] According to another embodiment of invention, the nail shaft can be formed solid. According to a further embodiment of the invention, one of the two distal transverse bores in the distal region is configured as an axis-parallel elongated hole.

[0013] With a shaft running straight, it is expedient for two separate humeral nails to be provided for the left-hand and the right-hand humerus. According to one embodiment of the invention, except for the proximal transverse bore, the remaining transverse bores are provided in a different arrangement for the left and the right nail shaft, the two arrangements being indeed similar with respect to the spacing and the angular position, but being rotated through 180° with respect to the longitudinal axis.

[0014] An example of embodiment of the invention will be explained below in greater detail with the aid of the drawings.

[0015] Fig. 1 shows the longitudinal view of a humeral nail for the right humerus in a side view.

[0016] Fig. 2 shows the side view of the nail according to fig. 1, rotated through 90°.
[0017] Fig. 3 shows a section through the nail according to fig. 1 along the line 3-3.

[0018] Fig. 4 shows the side view of an inventive humeral nail for the left humerus in a view analogous to fig. 2.

[0019] In figs. 1 to 3, there is shown a humeral nail 10 for the right humerus. It has a straight shaft with a proximal end 12 and a distal end 14. Nail 10 is put into the humerus from the proximal direction and serves for the surgical care of fractures in the proximal region of the humerus (not shown). Nail 10 is configured as a locking nail.

[0020] The nail shaft has a proximal portion 16, which extends up to an edge 18. The proximal portion 16 has a constant diameter. Edge 18, which can also be formed in a relatively smooth transition, is followed by a relatively short conical portion 20 and this, in turn, is followed by a further conical portion 22. From edge 24 of conical portion 22, the nail shaft extends up to distal end 14 approximately with the same smaller diameter, distal end portion 26 again being formed conically or being able to be spherical.

[0021] Proximal end 22 is provided with three transverse slits 28 running perpendicular to the longitudinal axis of the nail shaft, which co-operate with corresponding projections in a device for insertion and aiming, in order that nail 10 can be accommodated in the proper angular position by the device.

[0022] Proximal portion 16 has four transverse bores 30, 32, 34 and 36. The axes of middle bores 32, 34 are perpendicular to the longitudinal axis of nail 10, but are rotated through 115° with respect to each other. The axis of proximal transverse bore 30 is disposed diagonally to the longitudinal axis, e.g. at an angle of approximately 80°. Proximal transverse bore 30 partially intersects an axial threaded bore 40 of nail 10, which serves for the connection with the device (not shown) for insertion and aiming.

[0023] Bore 32 following as the next one to proximal bore 30 is arranged on the circumference offset by a certain angle of, for example, 25°. This offset can be seen relatively well in fig. 1. Distal transverse bore 36 also runs diagonal to the longitudinal axis of nail 10 with its axis, e.g. at an angle of 75°, the axes of transverse bores 30, 36 converging and diverging respectively. In addition, the axis of distal transverse bore 36 is rotated with respect to proximal transverse bore 30 in the circumferential direction, again through approximately 25°, but the rotation with respect to transverse bore 32 takes place in the opposite direction, which again emerges from fig. 1.

[0024] Transverse bores 30 to 36 serve for the accommodation of bone screws (not shown) which are screwed into the humerus head via the coricalis of the humerus. For locating transverse bores 30 to 36, a suitable aiming device (not shown) is required. The offset in the circumferential direction of the transverse bores with regard to each other enables the arrangement of the bone screws from different directions, in order to provide surgical care to the corresponding fractures in the humerus head in an optimal manner. The diagonal arrangement of transverse bores 30 and 36 enables an even more optimal care of fractures, with better transmission of force from the bone to the nail and conversely. In addition, the diagonal arrangement of transverse bores 30 and 36 enables the use of particularly long bone screws, without the danger existing that the humerus head might be pushed through. Bores 32 to 36 are provided with a thread, which corresponds to the locking or bone screws. An unintended drifting out of the screws is thus prevented.

[0025] Portion 27 of nail 10 has two transverse bores 42, 44 provided at a relative distance from distal end 14, the axes whereof lie in one plane in which the axis of proximal transverse bore 30 also lies. Distally positioned distal transverse bore 44 is configured as an elongated hole, which can be seen in particular from figs. 1 and 3. Transverse bores 42, 44 serve in turn for the accommodation of bone screws for the bracing of nail 10 in the humerus shaft.

[0026] As already mentioned, nail 10 according to figs. 1 to 3 serves for the surgical care of fractures in the right humerus. A nail 10a, as represented in fig. 4, is identical with its nail shaft to the shaft of nail 10 according to figs. 1 to 3. For that reason, the details of nail 10a will not be discussed further, except for proximal portion 16a, which also has four transverse bores 30a, 32a, 34a and 36a. The configuration of transverse bores 30a to 36a again resembles that according to figs. 1 to 3. The position of proximal transverse bore 30a is also identical to transverse bore 30 according to figs. 1 to 3. Only

the arrangement of transverse bores 32a to 36a is different to that according to figs. 1 to 3, in that this arrangement is mirror-like with respect to that according to fig. 2, for example. The different arrangement of nail 10a results purely from the fact that nail 10a is used for the left humerus. Thus, with respect to the humerus to be applied, i.e. the left or right one, the arrangement of transverse bores 30 to 36 and 30a to 36a is identical.

CLAIMS

1. A humeral nail for the surgical care of fractures of the proximal humerus, with an oblong shaft which has a longitudinal axis and comprises in a proximal portion (16, 16a) at least three transverse bores spaced apart in the axial direction, the axes whereof are offset from each other viewed in the circumferential direction of the shaft, and which has at least two further transverse bores in a portion lying towards the distal end, characterised in that the proximal transverse bore (30, 30a) runs diagonally with respect to the longitudinal axis and lies in the same plane as the axis of the other transverse bores (42, 44).

2. The humeral nail according to claim 1, characterised in that the axis of the proximal transverse bore (30) encloses an angle of approximately 80° with the longitudinal axis.

3. The humeral nail according to claim 1 or 2, characterised in that the axis of the distal transverse bore (36, 36a) in the proximal portion (16, 16a) also runs diagonally to the longitudinal axis, such that the axes of the proximal and distal transverse bore (30, 30a and 36, 36a) converge.

4. The humeral nail according to claim 3, characterised in that the axis of the distal transverse bore (36, 36a) encloses an angle of approximately 75° with the longitudinal axis.

5. The humeral nail according to claim 4, characterised in that the angular offset of the distal transverse bore (36, 36a) with respect to the proximal transverse bore (30, 30a) is approximately 25°.

6. The humeral nail according to any one of claims 3 to 5, characterised in that four transverse bores (30 to 36 and 30a to 36a) are provided in the proximal portion (16, 16a) of the nail shaft.

7. The humeral nail according to claim 6, characterised in that the second transverse bore (32, 32a) following the proximal transverse bore (30, 30a) is orientated with its axis approximately perpendicular to the longitudinal axis.

8. The humeral nail according to claim 6, characterised in that the third transverse bore (34, 34a) following the proximal transverse bore (30, 30a) is orientated with its axis approximately perpendicular to the longitudinal axis.

9. The humeral nail according to any one of claims 6 to 8, characterised in that the angular offset between the second transverse bore (32, 32a) and the proximal transverse bore (30, 30a) is approximately 25°.

10. The humeral nail according to any one of claims 6 to 9, characterised in that the angular offset between the third transverse bore (34) and the proximal transverse bore (30) is approximately 90°.

11. The humeral nail according to claim 5 and 9, characterised in that the angular offset of the second and fourth transverse bore (32, 32a, 36, 36a) relative to the axis of the proximal transverse bore (30, 30a) is directed into the opposite direction.

12. The humeral nail according to any one of claims 1 to 11, characterised in that the nail shaft is designed solid.

13. The humeral nail according to any one of claims 1 to 12, characterised in that the distal transverse bore (44) in the distal region is formed as an axis-parallel elongated hole.

14. The humeral nail according to any one of claims 1 to 12, characterised in that a nail shaft is provided for the right humerus and a nail shaft for the left humerus and the shafts are configured straight, the transverse bores in the proximal portion for the left and right humerus being arranged differently such that, except for the proximal transverse bore (30, 30a), the arrangement of the transverse bores (32 to 36 and 32a to 36a) for the left nail shaft is a mirror image with respect to that for the transverse bores of the right nail shaft.

15. The humeral nail according to any one of claims 1 to 14, characterised in that the transverse bores are provided with a thread, which corresponds to the thread of locking screws.